

CLAIMS

What is claimed is:

1. An apparatus comprising:  
a source that produces a feed beam;  
a first pair of sensors including  
a first sensor positioned to intercept and receive a first portion of  
5 the feed beam, wherein the first sensor has a first-sensor output signal, and  
a second sensor positioned to intercept and receive a second portion of  
of the feed beam and spaced apart from the first sensor along a first-pair axis,  
wherein the second sensor has a second-sensor output signal;  
a first phase-comparison device having as an input the first-sensor output  
10 signal and the second-sensor output signal, and as an output a first phase  
comparison of the first-sensor output signal and the second-sensor output signal;  
and  
a first geometrical calculator having as an input the first phase comparison  
and as an output a geometrical relationship of the first-pair axis to an other  
15 feature.
2. The apparatus of claim 1, wherein the source is a microwave  
source, the feed beam is a microwave feed beam, and the sensors are microwave  
sensors.
3. An apparatus comprising:  
a microwave source that produces a microwave feed beam;  
a first pair of microwave sensors including  
a first microwave sensor positioned to intercept and receive a first  
5 portion of the microwave feed beam, wherein the first microwave sensor has a  
first-sensor output signal, and  
a second microwave sensor positioned to intercept and receive a  
second portion of the microwave feed beam and spaced apart from the first

microwave sensor along a first-pair axis, wherein the second microwave sensor  
10 has a second-sensor output signal;

a first phase-comparison device having as an input the first-sensor output  
signal and the second-sensor output signal, and as an output a first phase  
comparison of the first-sensor output signal and the second-sensor output signal;  
and

15 a first geometrical calculator having as an input the first phase comparison  
and as an output a geometrical relationship of the first-pair axis to an other  
feature.

4. The apparatus of claim 3, wherein the geometrical relationship is  
a distance from the first-pair axis to the other feature.

5. The apparatus of claim 3, wherein the geometrical relationship is  
an angular relation between the first-pair axis and the other feature.

6. The apparatus of claim 3, wherein the first microwave sensor and  
the second microwave sensor are mounted to a common sensor support.

7. The apparatus of claim 3, wherein the first microwave sensor and  
the second microwave sensor are affixed to a microwave transmitter reflector.

8. The apparatus of claim 7, wherein the first microwave sensor and  
the second microwave sensor are mounted to a common sensor support, and  
wherein the common sensor support is mounted to the microwave transmitter  
reflector.

9. The apparatus of claim 3, wherein the first microwave sensor and  
the second microwave sensor are affixed to a microwave transmitter reflector, and  
wherein the transmitted microwave feed beam is reflected from the microwave  
transmitter reflector and into free space.

10. The apparatus of claim 3, further including  
a controller that receives as an input the geometrical relationship and has  
as an output a control signal that alters the geometrical relationship.

11. The apparatus of claim 3, wherein the other feature is the  
microwave feed beam.

12. The apparatus of claim 3, wherein the apparatus further includes  
a second pair of microwave sensors including

a third microwave sensor positioned to intercept and receive a third  
portion of the microwave feed beam, wherein the third microwave sensor has a  
5 third-sensor output signal, and

a fourth microwave sensor positioned to intercept and receive a  
fourth portion of the microwave feed beam and spaced apart from the third  
microwave sensor along a second-pair axis that is not parallel to the first-pair axis,  
wherein the fourth microwave sensor has a fourth-sensor output signal,

10 a second phase-comparison device having as an input the third-sensor  
output signal and the fourth-sensor output signal, and as an output a second phase  
comparison of the third-sensor output signal and the fourth-sensor output signal,  
and

15 a second geometrical calculator having as an input the second phase  
comparison and as an output a geometrical relationship of the second-pair axis to  
the other feature.

13. The apparatus of claim 12, wherein the first-pair axis and the  
second-pair axis intersect.

14. The apparatus of claim 12, wherein the first-pair axis and the  
second-pair axis intersect and are orthogonal to each other.

15. The apparatus of claim 12, wherein the first microwave sensor, the  
second microwave sensor, the third microwave sensor, and the fourth microwave

sensor are mounted to a common sensor support.

16. An apparatus comprising:
  - a microwave source that produces a transmitted microwave feed beam;
  - a first pair of microwave sensors including
    - a first microwave sensor positioned to intercept and receive a first portion of the transmitted microwave feed beam, wherein the first microwave sensor has a first-sensor output signal, and
      - a second microwave sensor positioned to intercept and receive a second portion of the transmitted microwave feed beam and spaced apart from the first microwave sensor along a first-pair axis, wherein the second microwave sensor has a second-sensor output signal;
      - a first phase-comparison device having as an input the first-sensor output signal and the second-sensor output signal, and as an output a first phase comparison of the first-sensor output signal and the second-sensor output signal;
      - a first geometrical calculator having as an input the first phase comparison and as an output an angular relationship of the first-pair axis to the transmitted microwave feed beam;
      - a second pair of microwave sensors including
        - a third microwave sensor positioned to intercept and receive a third portion of the transmitted microwave feed beam, wherein the third microwave sensor has a third-sensor output signal, and
          - a fourth microwave sensor positioned to intercept and receive a fourth portion of the transmitted microwave feed beam and spaced apart from the third microwave sensor along a second-pair axis that is not parallel to the first-pair axis, wherein the fourth microwave sensor has a fourth-sensor output signal;
          - a second phase-comparison device having as an input the third-sensor output signal and the fourth-sensor output signal, and as an output a second phase comparison of the third-sensor output signal and the fourth-sensor output signal;
          - a second geometrical calculator having as an input the second phase comparison and as an output an angular relationship of the second-pair axis to the transmitted microwave feed beam; and

a microwave transmitter reflector to which the first microwave sensor, the second microwave sensor, the third microwave sensor, and the fourth microwave sensor are affixed, wherein the transmitted microwave feed beam is reflected from the microwave transmitter reflector and into free space.

17. The apparatus of claim 16, further including  
a controller that receives as an input the angular relationships and has as an output a control signal that alters the angular relationships.

18. An apparatus comprising:  
a source that produces a microwave feed beam;  
at least two microwave sensors, wherein each microwave sensor is positioned to intercept and receive a portion of the microwave feed beam, and wherein each microwave sensor has a sensor output signal, and  
a phase-comparison device having as an input the sensor output signals, and as an output a phase comparison of the output signals; and  
a geometrical calculator having as an input the phase comparison and as an output a geometrical relationship of the microwave sensors.

19. The apparatus of claim 18, wherein all of the microwave sensors are mounted to a common sensor support.

20. The apparatus of claim 18, further including  
a controller that receives as an input the geometrical relationships and has as an output a control signal that alters the geometrical relationships.